

### REMARKS

Claims 1-5, 7 and 9-25 are now presented for examination. Claims 1, 10, 17, and 20 have been amended to define still more clearly what Applicants regard as their invention. Claims 24 and 25 have been added to provide Applicants with a more complete scope of protection. Claims 1 and 10 are in independent form. Favorable reconsideration is requested.

Claims 17 and 20 have been objected to, requiring that the antecedent basis of the recitation "surface observation apparatus" be corrected. In response, Applicants have changed "The surface observation apparatus" to -A surface observation apparatus-, as recommended by the Examiner.

Claim 1 was rejected under 35 U.S.C. § 112, second paragraph, as indefinite. Applicants have amended Claim 1 to read "the end of said *tip* is. . . ." Applicants believe that the rejection under Section 112, second paragraph, has been obviated, and its withdrawal is therefore respectfully requested.

Claims 1, 17-19, and 23 were rejected under 35 U.S.C. § 102(b) as being anticipated by U.S. Patent No. 5,351,229 (Brezoczsky et al.). Applicants respectfully traverse this rejection.

Claims 2-4, 9, and 17-19 were rejected under 35 U.S.C. § 103 (a) as being unpatentable over Brezoczsky et al.; Claims 5, 7, and 17-19 as being unpatentable over Brezoczsky et al. in view of U.S. Patent No. 5,354,985 (Quate); Claims 10-14, 16, and 20-22 as being unpatentable over Quate in view of U.S. Patent No. 6,396,050 B1 (Yamamoto et al.); and Claims 15 and 20-22 as being unpatentable over Yamamoto et al. in view of U.S. Patent No. 5,902,715 (Tsukamoto et al.). Applicants respectfully traverse these rejections.

Applicants submit that amended independent Claims 1 and 10, together with the remaining claims dependent thereon, are patentably distinct from the cited prior art at least for the following reasons.

Claim 1 is directed to a probe for detecting light or irradiating light. The probe includes a cantilever supported at an end by a substrate, a hollow tip formed at a free end of the cantilever, a microaperture formed at the end of the tip, and a groove formed inside the cantilever. The groove includes a hollow waveguide and a mirror.

The direction of the end of the tip is substantially perpendicular to the longitudinal direction of the cantilever, and the mirror is an end face of the groove and reflects the light entering from the microaperture toward the hollow waveguide or reflects the light transmitted in the hollow waveguide toward the microaperture.

Important features of Claim 1 is that the groove includes the hollow waveguide and the mirror, and the mirror is an end face of the groove. Support in the specification for these features can be found at least at page 10, lines 15-17; at page 11, lines 10-20; from page 18, line 25, to page 19, line 3; at page 19, lines 4-14; and Figures 3A-4C.

Brezoczsky et al., as understood by Applicants, relates to a tribo-attractive contact slider for an optical read/write system. Applicants note that the slider 51 (see Figs. 4 and 5) is not hollow and has a lens 64. In contrast, the present invention as recited in Claim 1 includes a groove formed inside a cantilever that includes a *hollow* waveguide and a mirror. In addition, in Brezoczsky et al., a light arrives at an optical disk 30 (see Fig. 5) via the lens 64. With these structural features (as shown in Fig. 5), the contact slider in Brezoczsky et al. could not obtain the advantageous effect of the present invention as recited in Claim 1 that a continuous space formed by both the hollows of the waveguide

and the tip realize their easy optical connection and low light transmission loss. Accordingly, since Applicants have found nothing in Brezoczsky et al. that would teach or suggest a probe that includes a groove comprising the hollow waveguide and the mirror, where the mirror is an end face of the groove, Applicants submit that at least for this reason, that Claim 1 is patentable over Brezoczsky et al.

Claim 10 is directed to a method for producing a probe for light detection or light irradiation. The method includes the steps of working a substrate to form a groove and a mirror at an end of the groove therein, with the mirror being a slanted or a concave end face of the groove; forming a flat plate-shaped cover portion on the groove to form a hollow waveguide having an opening in a part thereof; forming a hollow tip having a microaperture on the opening; and removing a part of the substrate by etching, to form a cantilever.

Important features of Claim 10 are the utilizing of a groove as the waveguide and the step of working a substrate to form a groove and a mirror at an end of the groove therein, with the mirror being a slanted or a concave end face of the groove.

Quate, as understood by Applicants, relates to a near field scanning optical and force microscope that includes a cantilever and an optical waveguide. In Quate, the  $\text{Si}_3\text{N}_4$  film 51 shown in Figure 5A functions as a waveguide, connecting with a pyramidal tip 52. Light passing through the film 51 is reflected on the side face of the tip 52 and is condensed at the opening of the tip. In contrast, the present invention as recited in Claim 10 includes a groove formed in the cantilever (as compared to a thin film 51) that functions as a waveguide. The utilizing of such a groove in Claim 10 makes it possible to form the mirror as an end face of the groove, whereby the optical connection of the waveguide and the tip can be easily realized in order to obtain a probe having little light transmission loss.

In addition, in Quate, the pyramidal tip 52 functions as a reflecting face and is located independently of the  $\text{Si}_3\text{N}_4$  film as a waveguide. Consequently, there is no relationship between the waveguide and mirror in Quate. Moreover, the mirror of the present invention as recited in Claim 10 has a slant or concave shape and therefore directs all the striking light to the microaperture. Consequently, the efficiency of the optical connection between the waveguide and the aperture is greater than the efficiency of the optical connection in Quate.

Yamamoto et al., as understood by Applicants, relates to a self-emitting optical probe, a method for producing the same, and a scanning near-field optical microscope. In Yamamoto et al., the waveguide is comprised of a hollow fiber, not a groove as recited in Claim 10. (See, e.g., col. 3, lines 40-44, which states, "[i]n the case of an optical probe using an ordinary optical *fiber* [emphasis added], the usable wavelength is limited by the fiber structure and the material constituting the fiber core portion which functions as the waveguide.") Such a hollow fiber cannot have a mirror face even if, for example, it is cut slantwise to expose an end face. As such, in Yamamoto et al., the invention requires that an additional portion, such as a dielectric substance, be arranged at an end portion of the waveguide. In contrast, the present invention as recited in Claim 10 utilizes the end face itself as the mirror so that it is not necessary to provide another reflective member such as the dielectric substance layer.

Applicants submit that, at least for the reasons discussed above, the proposed combination of Quate and Yamamoto et al., assuming such combination would even be permissible, would still fail to teach or suggest the utilizing of a groove as the waveguide and the step of working a substrate to form a groove and a mirror at an end of the groove therein, with the mirror being a slanted or a concave end face of the groove, as

recited in Claim 10. Accordingly, Applicants submit that Claim 10 is patentable over these two patents, taken separately or in any proper combination.

A review of the other art of record including Tsukamoto et al. has failed to reveal anything which, in Applicants' opinion, would remedy the deficiencies of the art discussed above, as references against the independent claims herein. Those claims are therefore believed patentable over the art of record.

The other claims in this application, including new Claims 24 and 25, are each dependent from one or another of the independent claims discussed above and are therefore believed patentable for the same reasons. Since each dependent claim is also deemed to define an additional aspect of the invention, however, the individual consideration or reconsideration, as the case may be, of the patentability of each on its own merits is respectfully requested.

This Amendment After Final Action is believed to place this application in condition for allowance and, therefore, its entry is believed proper under 37 C.F.R. § 1.116. Accordingly, entry of this Amendment After Final Action, as an earnest effort to advance prosecution and reduce the number of issues, is respectfully requested. Should the Examiner believe that issues remain outstanding, it is respectfully requested that the Examiner contact Applicants' undersigned attorney in an effort to resolve such issues and advance the case to issue.

In view of the foregoing amendments and remarks, Applicants respectfully request favorable reconsideration and early passage to issue of the present application.

Applicants' undersigned attorney may be reached in our New York office by telephone at (212) 218-2100. All correspondence should continue to be directed to our below listed address.

Respectfully submitted,

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